

TOXIC EFFECT OF LEAD AND MERCURY ON GERMINATION OF GRAM SEEDS

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ABSTRACT

This paper presents the effect of lead and mercury on germination of gram (*Cicer arietinum*). Lead and mercury are the most common heavy metal. These are not essential elements for plants but get absorbed when they are present in the soil. To investigate the effects of lead and mercury in seed germination, gram was germinated under stressed conditions of lead and mercury at different concentrations. 1 % and 2% solutions of each lead and mercury were made and gram seeds were soaked in it overnight. After soaking the seeds were kept in the dark for germination. A control was also made by soaking gram in distilled water so as to compare the extent of the effect of the heavy metals. It was noticed that gram showed reduced seed germination under the influence of heavy metals and the control showed normal seed germination. Mercury was seen to be the most inhibitory metal which caused complete inhibition of germination of gram seeds.

KEYWORDS: Lead, Mercury, Heavy Metal, Inhibition and Seed Germination

INTRODUCTION

Soil is the most important environmental factor for the growth and development of plant. Soil is being polluted by dumping hazardous wastes and contaminants containing heavy metals. Thus the soil becomes unfertile and unproductive due to contamination. The plants growing in such a soil show reduced growth. It has been observed that plants are exposed with many harsh environmental conditions like biotic and abiotic stress. Apart from all others stresses heavy metal stress is one of great major issue which has a notable harsh effects on crop productivity and growth. Heavy metals known to interfere the environment. Vegetation in the vicinity of polluted area are known to accumulate quite high level of heavy metal (Banerji and Kumar 1979). A metal with relatively high atomic weight is known as a heavy metal. Heavy metals occur in the atmosphere in varying concentrations. The accumulation of these heavy metals in the body of a plant can cause serious illness. They may enter the food chain and enter human body via plants and cause serious damages to the body. Heavy metals mainly affect the metabolism. The term “heavy metals” refers to any metallic element that has a relatively high density and is toxic or poisonous even at low concentration (Lenntech Water Treatment and Air Purification, 2004).

Heavy metals include lead (Pb), cadmium (Cd), nickel (Ni), cobalt (Co), iron (Fe), zinc (Zn), chromium (Cr), iron (Fe), arsenic (As), silver (Ag) and the platinum group elements.

Lead (Pb), a potentially toxic heavy metal with no known biological function, has attracted more and more considerable attention for its widespread distribution and potential risk to the environment. Lead enriched in the body of humans through the food chain and endangered their health (Liu et al., 2003).

There are different sources of heavy metals in the environment such as: natural, agricultural, industrial, domestic effluent, atmospheric sources and other sources. Many activities such as mining has contaminated world such as Japan, Indonesia and China and that too mostly by heavy metals such as Cd, Cu and Zn (Herawati et al., 2000). Soil is mainly

contaminated by heavy metals by xenobiotic (human made) contaminants. Heavy metals are incorporated in to the soil mainly by Industrial wastes, mining electronic wastes, pesticides etc. The present study is done so as to determine the extent of toxicity of heavy metals (lead and mercury) on seed germination at different concentrations.

METHODOLOGY

Reagent Preparation

Preparation of Mercuric Chloride solution: 1 % Solution: 1 mg mercuric chloride in 100 ml of distilled water (10,000 ppm), 2 % Solution: 2 mg mercuric chloride in 100 ml of distilled water (20,000 ppm)

Preparation of Lead Acetate solution - 1 % Solution: 1 mg lead acetate in 100 ml of distilled water (10,000 ppm), 2 % Solution: 2 mg lead acetate in 100 ml of distilled water (20,000 ppm).

Soaking of Gram Seeds Overnight

Fresh Gram seeds were taken and dipped in each of the above made solutions and kept overnight. A control is also made by dipping gram seeds in distilled water to measure the extent of toxicity. The seeds will absorb water by the process of osmosis and will get swelled up.

In case of solution containing heavy metals the gram seeds will absorb it along with water.



Figure 1: 1 % Solution (Lead Acetate)



Figure 2: 2 % Solution (Lead Acetate)



Figure 3: 1 % Solution (Mercuric Chloride)

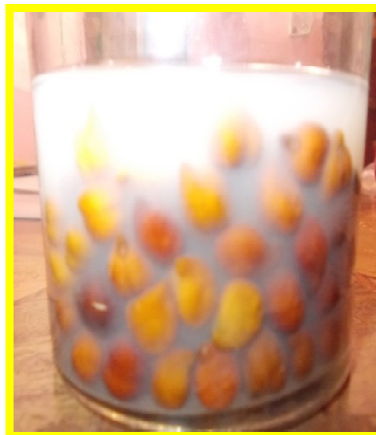


Figure 4: 2 % Solution (Mercuric Chloride)

Keeping the Seeds in Dark

When the seeds were swelled up they were removed from their respective solutions and kept on the petriplates separately. Then the petriplates were kept in the dark room for germination of seeds. Proper conditions for germination should be maintained such as proper light and dark period, proper moisture, proper aeration.

RESULTS AND DISCUSSIONS

During the experiment it has been observed that the treatment with mercury and lead inhibits the germination of seeds, also in increasing percentage that is in 2% of heavy metals has stopped the germination and growth of seeds. In the investigation control plates had shown proper germination where as 10 % of seeds soaked in 1% mercury has shown little growth from 4 day but in lead it has shown no germination. Seeds soaked in 2% percent lead and mercury solution has shown no germination (figure: 5,6,7,8,9). It has also been observed that mercury is less toxic to lead. Kalimuthy & Siva, 1990 stated that the decrease in seed germination may be due to the breakdown of stored food material in seed, due to the toxic effect of mercury and lead. Khan (2013) studied the effect of lead and mercury on *cassia* species and concluded that effect of lead and mercury at higher concentration is more prominent as compared to lower concentration of lead and mercury. According to Eun and his coworkers (2000) Pb can also disturb microtubule organization in meristematic cells. John *etal* (2009) observed that the varied concentrations of Cd and Pb, affects the fresh weight of *B. juncea*. The greater impact of heavy metal was observed on the root growth as compared to shoot leading to a greater reduction in its length and fresh weight (Elloumi et al., 2007). Atta *etal* (2014) studied the effects of Pb, Hg and Cr heavy metals on two sunflower varieties (Hysun-33 and SF-5009) and stated that heavy metals affected the germination time of seeds.

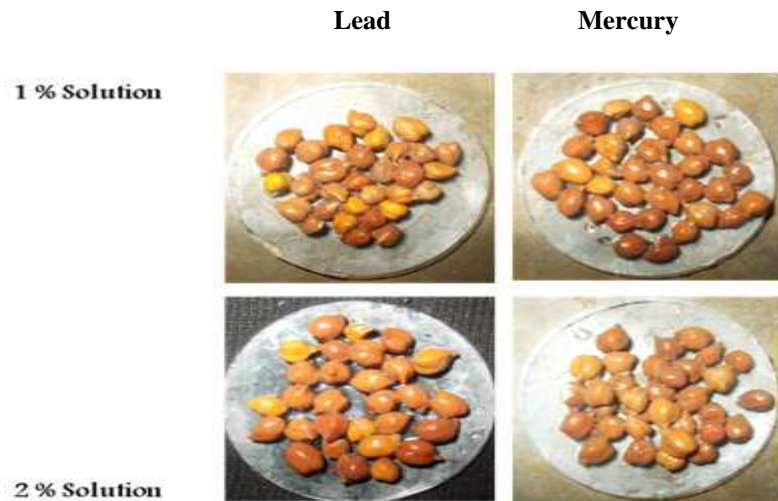


Figure 5: Day 1 Seeds Soaked in Lead Acetate Solution and Mercury Chloride



Figure 6: Day 2 Seeds Soaked in Lead Acetate Solution and Mercury Chloride



Figure 7: Day 3 Seeds Soaked in Lead Acetate Solution and Mercury Chloride



Figure 8: Day 4 Seeds Soaked in Lead Acetate Solution and Mercury Chloride



Figure 9: Day 5 Seeds Soaked in Lead Acetate Solution and Mercury Chloride

CONCLUSIONS

Heavy metals are toxic for humans and plant growth. In this we can conclude that lead and mercury are toxic. This is major area which needs to concentrate for its removal. However it can be removed by microorganisms.

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